SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
Minor 1 (Even Semester) – 2017-18

Entry No: | 1 | 6 | B | M | E | 0 | 0 | 7 |

Total number of pages:[1]
Total number of questions: 4

B.Tech. || MECHANICAL ENGG || Sem IV

Fluid Machines

Subject Code: MEL-2232

Time allowed: 1 Hr **Max Marks: 20**

Important Instructions:

- All questions are compulsory
- Assume any missing data

PART A

Q. 1. Short-Answer Questions: [1 x5=5]

(a) Give the design consideration for eliminating axial thrust in case of Pelton wheel turbines.

(b) The function of a casing in case of impulse turbines is different from that of reaction turbines. Justify?

(c) Write down Euler's momentum equation and state what does it represents.

(d) Draw the inlet and outlet velocity triangle for the jet striking at the centre of pelton wheel bucket.

(e) Define hydraulic efficiency of a pelton turbine.

...

PART B

Q. 2. Explain the governing mechanism of the Pelton wheel turbine. [5]

Q. 3. Prove that the force exerted by a jet striking at the centre in case of stationary curved vane is always greater than that of the case for a flat plate. Also find out the condition where this force is twice the force exerted for a flat plate held stationary in a direction perpendicular to the jet. [5]

Q. 4. A single jet Pelton wheel runs at 330 rpm under a head of 500 m. The jet diameter is 100 mm, its deflection inside the bucket is 165° and its relative velocity is reduced by 15% due to friction. Find : (i) water horse power (ii) resultant force on the bucket, (iii) brake power if mechanical losses are 5 % of power supplied, and overall efficiency. Assume suitable values for the velocity coefficient and speed ratio. [5]

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PART A

Q. 1. Short-Answer Questions: [1 x5=5]

(a) Why the blades of a Kaplan turbine are twisted?

(b) Why the efficiency of a Kaplan turbine is high at part loads in comparison to Propeller turbines?

(c) In context to Hydraulic turbines, what does R = 1 signifies. Is it possible to have R = 1. Give reason. (where, R has the usual meaning)

(d) What is the significance of the Thoma's cavitation number?

(e) Give the function of draft tube

PART B

Q. 2. Define specific speed and find out the expression for the specific speed of a Pelton wheel turbine. [5]

Q. 3. The following data pertains to an inward flow reaction turbine: Net Head = 60 m ; speed 650 rpm; brake power = 275 kW. Ratio of wheel width to wheel diameter at inlet = 0.10. Ratio of inner diameter to outer diameter = 0.5. Flow ratio K_f=0.17 ; hydraulic efficiency = 95% and overall efficiency = 85%. The flow velocity remains constant and the discharge is radial. Neglecting the area blockage by blades. Find out the main dimensions and blade angles of the turbine. [5]

Q. 4. In a project of hydroelectric scheme, 300 m^3/s of water is available under a head of 15 m. Alternative schemes are proposed using Francis turbines with specific speed 395 and Kaplan turbines with specific speed 680. If normal running speed is 150 rpm, determine the number of machines needed in two cases. The units in any on installation are to be of equal power and the turbine efficiency may be assumed 90 %. Also work out the power output by the machine in each case. [5]

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
Minor 1 (Even Semester) – 2018-19

Entry No: | | | | | | | | | |

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B.Tech. || MECHANICAL ENGG || Sem IV

Fluid Machines

Subject Code: MEL-2232

Time allowed: 1.5 Hrs **Max Marks: 20**

Important Instructions:

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- Assume any missing data

PART A

Q. 1. Short-Answer Questions: **[1 x5=5]**

(a) What is a friction factor in case of impact of jets? How it effects the outlet velocity?

(b) Give the design considerations for eliminating the axial thrust in case of the Pelton wheel turbines.

(c) Why the buckets are not exactly semicircular in case of Pelton wheel turbine?

(d) Is it practically possible to get 100% efficiency in case the jet impinges on series of curved vanes mounted on the periphery of a wheel? If no, then give the reasons.

(e) Give the implications of Impulse momentum principle.

PART B

Q. 2. Prove that the maximum efficiency for a system with jet striking at the center of a moving semicircular vane is 59.2% **[5]**

Q. 3. A nozzle of 70 mm diameter delivers a stream of water that strikes a flat plate which is held normal to the axis of stream. If the issuing jet has a velocity of 24 m/s, make calculations for the **[5]**

a) Force exerted on the plate if held stationary.

b) Force exerted on the plate, work done per second and the jet efficiency if the plate moves in the direction of jet at 10 m/s.

c) Work done if the plate is replaced by a series of plates moving with a velocity of 16 m/s.

Q. 4. Prove that the force exerted by a jet striking at the center in case of the stationary curved vane is always greater than that of the case for a flat plate. Also find out the condition where this force is twice the force exerted for a flat plate held stationary in a direction perpendicular to the jet **[5]**

SHRI MATA VAISHNO DEVI UNIVERSITY, KATRA
Minor 2 (Even Semester) – 2018-19

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Fluid Machines

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PART A

Q. 1. Short-Answer Questions: **[1 x5=5]**

(a) What is the function of a bell crank lever in the governing mechanism of a Pelton wheel turbine?

(b) Define hydraulic efficiency of Pelton turbine.

(c) Give the criteria for selecting the number of buckets in case of the Pelton wheel turbines.

(d) Differentiate between bucket power and water power.

(e) Draw the outlet velocity triangle for jet striking tangentially to a moving curved vane

PART B

Q. 2. Differentiate between Impulse and reaction turbine? Classify turbines on the basis of specific speed. [5]

Q. 3. Define different types of efficiencies in the Pelton wheel turbine. Prove that combination of all the efficiencies represents the overall efficiency of the turbine. [5]

Q. 4. The following data refers to a Pelton turbine that generates 4000 kW under a head of 300 m, speed ratio = 0.45; coefficient of velocity for nozzle= 0.97, jet ratio= 12; angle of deflection = 165°; overall efficiency= 86%; generator efficiency= 96% and frictional loss of buckets=10%. Determine [5]

a) Diameter of jet

b) Mean diameter of runner

c) Force exerted by jet on the buckets

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Q. 1. Discuss Impulse momentum principle. Derive the force exerted by a jet on a hinged plate. **[4]**

Q. 2. Tabulate the force exerted and work done by the jet in case of flat and curved vanes under different flow conditions. Also, write down the conditions for maximum efficiencies and the values of corresponding maximum possible efficiencies in all the cases. **[8]**

Q. 3. Differentiate between Impulse and reaction turbines **[4]**

Q. 4. A jet having a velocity of 24 m/s strikes the flat plate which is inclined at an angle of 45° to the axis of jet. The diameter of the jet is 100 mm. If the plate is moving at 8 m/s in the direction of jet, Find out the force exerted on the plate in normal direction, work done and efficiency of the system. **[4]**